The last two columns give the differences of the residuals found from each of the formulæ and from the means of the catalogue comparisons given in the previous table.

With the exception of the discordance referred to above, the close agreement between the N.P.D.'s found from the Greenwich and Cape observations is very remarkable.

1881, *November* 5.

Ephemeris for finding the Positions of the Satellites of Uranus, 1882.

By A. Marth, Esq.

In October the Earth has passed through the planes of the orbits of the satellites of *Uranus* from the side on which it had been since 1840 to the other side, on which the satellites appear to move in the direction of *increasing* position-angles, and on which, after returning next spring for some months to the former side, it will remain till the year 1923. In view of the importance of securing series of observations of the satellites during the present apparition of the planet, the ephemeris is made to begin a month earlier than would otherwise be necessary.

The angle of position p_0 of the major axes, the major and minor semiaxes a and b of the apparent ellipses described by the satellites, and the latitude of the Earth above the assumed plane of their orbits, are the following:—

		Ariel.		*Umbriel.*		*Titania.*		*Oberon.*		
Greenwich Noon.	p_0	a_1	b_1	a_2	b_2	a_3	b_3	a_4	b_4	Lat. of Earth.
1881.	°	″	″	″	″	″	″	″	″	°
Dec. 10	15·24	14·52	+0·67	20·22	+0·94	33·17	+1·53	44·35	+2·05	+2·65
20	15·25	14·63	0·70	20·37	0·97	33·42	1·59	44·69	2·13	2·73
30	15·25	14·76	0·70	20·56	0·98	33·73	1·60	45·11	2·14	2·72
1882.										
Jan. 9	15·24	14·89	+0·68	20·74	+0·95	34·02	+1·55	45·50	+2·07	+2·61
19	15·22	15·01	0·63	20·91	0·88	34·30	1·45	45·86	1·93	2·42
29	15·20	15·11	0·57	21·05	0·79	34·53	1·29	46·18	1·73	2·15
Feb. 8	15·17	15·19	0·48	21·17	0·67	34·72	1·10	46·43	1·47	1·81
18	15·14	15·25	0·38	21·25	0·53	34·86	0·87	46·61	1·16	1·42
28	15·10	15·29	0·27	21·30	0·37	34·93	0·61	46·72	0·82	1·00
Mar. 10	15·06	15·29	0·15	21·31	0·21	34·95	0·35	46·74	0·47	0·57
20	15·01	15·27	+0·04	21·28	+0·06	34·90	+0·09	46·68	+0·12	+0·15
30	14·97	15·23	−0·07	21·21	−0·09	34·80	−0·15	46·53	−0·21	−0·25
Apr. 9	14·93	15·16	0·16	21·12	0·23	34·64	0·37	46·32	0·50	0·61
19	14·90	15·07	0·24	20·99	0·34	34·43	0·55	46·04	0·74	0·92
29	14·88	14·96	0·30	20·84	0·42	34·18	0·69	45·71	0·92	1·15
May 9	14·86	14·84	0·34	20·67	0·47	33·91	0·77	45·35	1·03	1·31
19	14·85	14·71	0·35	20·49	0·49	33·61	0·80	44·95	1·07	1·38
29	14·85	14·58	−0·35	20·31	−0·48	33·31	−0·79	44·55	−1·06	−1·36

Longitudes of the satellites in their orbits reckoned from the points where they are at their greatest northern elongations :—

	Ariel.		*Umbriel.*		*Titania.*		*Oberon.*	
Greenwich Noon.	Long.	Diff.	Long.	Diff.	Long.	Diff.	Long.	Diff.
1881.	°	°	°	°	°	°	°	°
Dec. 10	258·38	1428·47	160·09	868·76	188·35	413·55	327·70	267·42
20	246·85	·47	308·85	·76	241·90	·54	235·12	.41
30	235·32	·47	97·61	·75	295·44	·53	142·53	·40
1882.								
Jan. 9	223·79	·44	246·36	·72	348·97	·51	49·93	·38
19	212·23	·41	35·08	·71	42·48	·50	317·31	·37
29	200·64	·38	183·79	·68	95·98	·49	224·68	·36
Feb. 8	189·02	·35	332·47	·67	149·47	·47	132·04	·35
18	177·37	·33	121·14	·65	202·94	·46	39·39	·33
28	165·70	·30	269·79	·63	256·40	·46	306·72	·34
Mar. 10	154·00	·28	58·42	·62	309·86	·45	214·06	·34
20	142·28	·26	207·04	·61	3·31	·45	121·40	·33
30	130·54	·24	355·65	·60	56·76	·44	28·73	·34
Apr. 9	118·78	·23	144·25	·60	110·20	·45	296·07	·34
19	107·01	·23	292·85	·60	163·65	·46	203·41	·35
29	95·24	·22	81·45	·60	217·11	·47	110·76	·35
May 9	83·46	·22	230·05	·61	270·58	·47	18·11	·37
19	71·68	1428·21	18·66	868·61	324·05	413·48	285·48	267·38
29	59·89		167·27		17·53		192·86	

These values are to be interpolated for the times for which the positions of the satellites are required. The position-angles p and distances s are then to be found by means of the formulæ :—

$$s \sin (p - p_0) = b \sin \text{long.}$$
$$s \cos (p - p_0) = a \cos \text{long.}$$

The satellites move in the direction of *in*creasing position-angles when b is positive, and in the direction of *de*creasing position-angles when b is negative, and will be at their greatest elongations ("N" in posit. p_0 and "S" in posit. $p_0 + 180°$), and at their superior and inferior conjunctions with the planet at or about the following hours, Greenwich mean time :—

Ariel.

1881.	N. d	N. h	S. d	S. h
Dec.	10	17·1	11	23·3
	13	5·6	14	11·8
	15	18·0	17	0·3
	18	6·5	19	12·8
	20	19·0	22	1·3
	23	7·5	24	13·7
	25	20·0	27	2·2
	28	8·5	29	14·7
	30	21·0		
1882.			Jan. 1	3·2
Jan.	2	9·4	3	15·7
	4	21·9	6	4·2
	7	10·4	8	16 6
	9	22·9	11	5·1
	12	11·4	13	17·6
	14	23·9	16	6·1
	17	12·3	18	8·6
	20	0·8	21	7·1
	22	13·3	23	19·6
	25	1·8	26	8·0
	27	14·3	28	20·5
	30	2·8	31	9·0
Feb.	1	15·3	2	21·5

1882.	N. d	N. h	S. d	S. h
Feb.	4	3·8	5	10·0
	6	16·2	7	22·5
	9	4·7	10	11·0
	11	17·2	12	23·5
	14	5 7	15	12·0
	16	18·2	18	0·4
	19	6·7	20	12·9
	21	19·2	23	1·4
	24	7·7	25	13·9
	26	20·2	28	2·4
Mar.	1	8·7	2	14·9
	3	21·1	5	3·4
	6	9 7	7	15·9
	8	22·1	10	4·4
	11	10·6	12	16·9
	13	23·1	15	5·4
	16	11·6	17	17·8
	19	0·1	20	6·3
	21	12·6	22	18·8
	24	1·1	25	7·3
	26	13·6	27	19·8
	29	2·1	30	8·3
	31	14·6	A. 1	20·8

1882.	N. h	N. h	S. d	S. h
April	3	3·1	4	9·3
	5	15·5	6	21·8
	8	4·0	9	10·3
	10	16·5	11	22·8
	13	5·0	14	11·3
	15	17·5	16	23·8
	18	6·0	19	12·3
	20	18·5	22	0·8
	23	7 0	24	13·3
	25	19·5	27	1·8
	28	8·0	29	14·3
	30	20·5	M. 2	2·7
May	3	9·0	4	15·2
	5	21·5	7	3·7
	8	10·0	9	16·2
	10	22·5	12	4·7
	13	11·0	14	17·2
	15	23·5	17	5·7
	18	12·0	19	18·2
	21	0·4	22	6·7
	23	12·9	24	19·2
	26	1·4	27	7·7
	28	13·9	29	20·2

Umbriel.

1881.	N. d	N. h	S. d	S. h
Dec.	12	7·2	14	9·0
	16	10·7	18	12·4
	20	14·1	22	15·9
	24	17·6	26	19·3
	28	21·0	30	22·8
1882.				
Jan.	2	0·5	4	2·2
	6	3·9	8	5·7
	10	7·4	12	9·3
	14	10·9	16	12·6
	18	14·3	20	16·0
	22	17·8	24	19·5
	26	21·2	28	23·0
	31	0·7	F. 2	2·4

1882.	N. d	N. h	S. d	S. h
Feb.	4	4·2	6	5·9
	8	7·6	10	9·3
	12	11·1	14	12·8
	16	14·5	18	16·3
	20	18·0	22	19·7
	24	21·5	26	23·2
Mar.	1	0·9	3	2·7
	5	4·4	7	6·1
	9	7·9	11	9·6
	13	11·3	15	13·1
	17	14·8	19	16·5
	21	18·3	23	20·0
	25	21·7	27	23·5
	30	1·0	A. 1	2·9

1882.	N. d	N. h	S. d	S. h
Apr.	3	4·7	5	6·4
	7	8·1	9	9·9
	11	11·6	13	13·3
	15	15·1	17	16·8
	19	18·6	21	20·3
	23	22·0	25	23·8
	28	1·5	30	3·2
May	2	5·0	4	6·7
	6	8·4	8	10·2
	10	11·9	12	13·6
	14	15·4	16	17·1
	18	18·8	20	20·6
	22	22·3	25	0·0
	27	1·8	29	3·5

Titania.

N. elong.		h	Inf. Conj.		h	S. elong.		h	Sup. Conj.		h
1881.		—			—	Dec.	9	19·2	Dec.	11	23·4
Dec.	14	3·6	Dec.	16	7·8		18	12·1		20	16·3
	22	20·5		25	0·8		27	5·0		29	9·2
	31	13·5									
1882.			Jan.	2	17·7	Jan.	4	21·9	Jan.	7	2·2
Jan.	9	6·4		11	10·6		13	14·9		15	19·1
	17	23·2		20	3·6		22	7·8		24	12·1
	26	16·3		28	20·5		31	0·8	Feb.	2	5·0
Feb.	4	9·2	Feb.	6	13·5	Feb.	8	17·7		10	22·0
	13	2·2		15	6·4		17	10·7		19	14·9
	21	19·2		23	23·4		26	3·7		28	7·9
March	2	12·1	March	4	16·4	March	6	20·6	March	9	0·9
	11	5·1		13	9·3		15	13·6		17	17·8
	19	22·1		22	2·3		24	6·6		26	10·8
	28	15·1		30	19·3	April	1	23·5	April	4	3·8
April	6	8·0	April	8	12·3		10	16·5		12	20·8
	15	1·0		17	5·2		19	9·5		21	13·7
	23	18·0		25	22·2		28	2·5		30	6·7
May	2	10·9	May	4	15·2	May	6	19·4	May	8	23·7
	11	3·9		13	8·2		15	12·4		17	16·6
	19	20·9		22	1·1		24	5·3		26	7·6
	28	13·8									

Oberon.

N. elong.		h	Inf. Conj.		h	S. elong.		h	Sup. Conj.		h
1881.											
Dec.	11	5·0	Dec.	14	13·8	Dec.	17	22·5	Dec.	21	7 3
	24	16·1		28	0·9		31	9·6			
1882.									Jan.	3	18·4
Jan.	7	3·2	Jan.	10	12·0	Jan.	13	20·8		17	5·5
	20	14·3		23	23·1		27	7·9		30	16·7
Feb.	3	1·5	Feb.	6	10·3	Feb.	9	19·1	Feb.	13	3·8
	16	12·6		19	21·4		23	6·2		26	15·0
March	1	23·8	March	5	8·6	March	8	17·4	Mar.	12	2·2
	15	11·0		18	19·8		22	4·6		25	13·4
	28	22·2	April	1	7·0	April	4	15·8	April	8	0·6
April	11	9·4		14	18·2		18	3·0		21	11·8
	24	20·6		28	5·4	May	1	14·2	May	4	23·0
May	8	7·7	May	11	16·5		15	1·3		18	10·1
	21	18·9		25	3·7		28	12·5			

During the period of 170 days, over which the Ephemeris extends, there will be some 230 occasions when two of the satellites pass one another at a short distance. As I have not learnt how close to the planet the satellites can be seen with some of the most powerful modern telescopes, I have not altered the limits adopted last January * for excluding the conjunctions which do not offer some fair prospect of being observable in Europe or America. I give now for the others a list similar to that printed on pp. 155 and 156, containing the computed position-angles and distances of the satellites which pass one another, for the nearest preceding and following even hour, Gr. M. T., so that the circumstances of each conjunction may be seen at a glance. The present list extends only to the end of January; the concluding portion will be communicated next month.

			Ariel.		*Umbriel.*		*Titania.*		*Oberon.*	
		G.M.T.	Pos.	Dist.	Pos.	Dist.	Pos.	Dist.	Pos.	Dist.
1881.		h	°	"	°	"	°	"	°	"
Dec.	15	16	14·7	14·3	8·7	7·8	20·5	15·3	—	
		18	15·2	14·6	10·5	10·1	21·4	13·6	—	
		20	15·8	14·3	11·6	12·2	22·5	11·7	—	
		22	16·4	13·4	12·5	14·2	24·1	9·8	—	
	28	16	—		—		200·0	16·3	186·4	13·2
		18	—		—		200·8	15·0	187·5	14·9
		20	—		—		201·7	13·2	188·3	16·5
1882.										
Jan.	17	18	16·8	12·5	7·0	6·0	—		5·5	11·2
		20	17·7	10·5	9·7	9·7	—		6·8	12·9
		22	19·0	8·1	11·1	11·1	—		7·9	14·6
	18	16	—		—		16·5	30·1	12·2	28·5
		18	—		—		16·7	29·0	12·4	29·9
	23	20	195·3	15·0	—		199 6	16·0	—	
		22	195·8	14·6	—		200·3	14·2	—	
	24	20	—		195·3	21·0	—		189·9	18·3
		22	—		195·6	20·7	—		190·5	19·9
	25	0	—		195·9	20·1	—		190·9	21·5
	29	10	—		197·0	16·1	190·2	13·7	—	
		12	—		197·5	14·3	190·9	15·5	—	
		14	—		198·2	12·3	191·5	17·4	199·0	22·9
		16	—		—		192·0	19·1	199·3	21·4
		18	—		—		192·4	20 8	199·7	19·8
	31	10	—		16·5	17·5	—		9·4	15·4
		12	—		17·0	15·9	—		10·1	17·0

* In the Note "On the Apparent Conjunctions of the Satellites of *Uranus* with each other, 1881," published in the *Monthly Notices* of January 1881.